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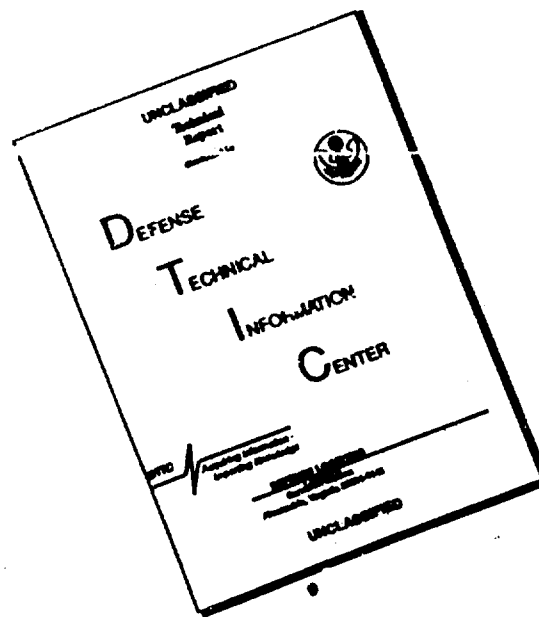
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AN ANALYSIS OF THE GROWTH AND DEGENERATION OF PHYSIOLOGICAL
RACES OF WHEAT STEM RUST IN 1964

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1964 was the epiphytotic year of wheat stem rust in all China, and was also the year of simultaneous epiphytotics of stripe and stem rust of wheat. Stem rust occurred in all of the wheat growing regions of the country but the degree of severeness was not uniform; it was mild in the south and severe in the north.

A total of 2,835 stem rust summer spore specimens were collected from 229 municipalities and hsien of the 26 provinces of the country in the year of 1964; only 1,854 specimens survived the culture process. After identification, 152 races were isolated from the mixed specimens and 2,006 specimens were identified in all.

The isolation of the races was carried out in heated rooms during the period from November 1964 to March 1965. The process of identification and the standard of recording were in accordance with common international rules. Aside from the 12 international hosts for identification purposes, 16 other wheat varieties, including a few current Chinese varieties, a few varieties soon to be recommended in China, and the current rust resistant parent pure varieties were also used as hosts for identification. The reaction of eight of these hosts with which the physiological races and strains known in China could be identified was described in Table 1. The result of analysis

was presented in Table 2. A comparison of the results of the study in 1964 and that of other years was presented in Table 3 and Table 4.

The identification process of the 2,006 stem rust summer spore specimens collected from all over the country produced 11 races and strains of wheat stem rust No. 17, 19, 21, 21C1, 21C2, 21C3, 34, 34C1, 34C2, 40 and 194; the physiological strain of 34C2 and the race of 194 were discovered for the first time. Regarding the trend of racial dominance, the physiological race No. 21, which includes 21C1, 21C2, and 21C3, accounts for 83.0%. The physiological race No. 34, which includes 34C1 and 34C2, was second in line, accounting for 15.0%.

Table 1. Reaction of Young Sprouts of Eight Hosts to the Physiological Races and Strains of Wheat Stem Rust

(1) 生理小种 或生理型*	(2) 鉴别寄主上的反应型							
	(3) 墨西哥	(4) 墨西哥	(5) 墨西哥	(6) 墨西哥	(7) 墨西哥	(8) 墨西哥	(9) 墨西哥	(10) 墨西哥
17	4-	0,	3**	3	1-	0	0	0
19	2-	0,	3**	3	0,	4	4	0
21	4	0	4-	1-	0,	0	0	0
21C1	4	0	4	1	0,	4	0	0
21C2	4	0	4	1	0,	0	4	0
21C3	4	0	4	1	0,	4	4	0
34	4-	4-	4±	1-	0,	0	4	0
34C1	4	4	4	1	0,	4	4	0
34C2	4	4	4	1	0,	4	4	4
40	4+	4	4-	0,	4-	4	4	4
194	4-	0	0,1	0,1-	0,1-	0	4	0

* C代表我国生理型的编号 (11)

1. Physiological races or physiological strains;
2. Reaction of the host; 3. Ma-k'uo-ssu; 4. Lui-lang-ssu;
5. K'u-pan-k'a; 6. Ai-ying-k'ang; 7. Fou-na-erh; 8. T'u 52;
9. Hua-tung No. 6; 10. Ming-ni No 2761; 11. C represents the physiological strain in China.

After the initial appearance of the physiological race of No. 19 in 1963, it appeared again in Fukien and Kiangsu provinces in 1964, and its disease causing capacity for the current varieties was determined to be rather strong; therefore special attention should be given to this race. The harmful nature of the newly isolated No. 194 regarding the productive varieties of wheat in China was in need of further clarification. A specimen was obtained from Nan-ta 2419 [a common wheat variety in China], in Wang-t'ing, Kiangsu Province. Repeated identification showed that this was a new strain of the physiological race No. 34, and it was named 34C2. Ming-ni 2761 was resistant to 34 and 34C1 but was susceptible to 34C2.

Special attention should be given to the problem of the appearance of No. 34C2 in connection with the hybridization work using Ming-ni 2761.

Table 2. Rate of Appearance of the Physiological Races and Strains of Wheat Stem Rust in 1964.

(1) 样品的来源省名	(2) 样品个数	(3) 鉴定次数	(4) 生理小种及其生理型的出现次数												小种数(个)(5)
			17	19	21	21C1	21C2	21C3	24	24C1	24C2	40	104		
Kwangtung	43	43	0	0	22	3	14	2	2	0	0	0	0	5	
Kwangsi	94	96	0	0	27	4	31	27	3	1	0	1	0	7	
Fukien	38	39	0	1	12	3	14	6	2	0	0	0	1	7	
Chekiang	78	78	0	0	20	1	31	12	13	1	0	0	0	6	
Kiangsu	231	235	1	1	83	13	70	30	21	7	1	3	1	11	
Shantung	113	113	1	0	28	6	22	21	17	12	0	5	2	9	
Liaoning	68	68	0	0	6	4	8	22	12	12	0	3	1	8	
Kirin	109	112	0	0	22	2	40	28	11	6	0	0	0	6	
Heilungkiang	174	177	1	0	33	2	85	37	37	25	0	4	0	8	
Hunan	16	16	0	0	9	0	4	2	1	0	0	0	0	4	
Hupei	93	93	0	0	26	3	47	16	1	0	0	0	0	5	
Kiangsi	23	23	0	0	7	2	3	10	0	1	0	0	0	5	
Anhui	117	119	0	0	44	9	27	21	10	6	0	0	1	7	
Honan	140	141	1	0	49	10	46	23	6	4	0	1	0	7	
Shensi	59	56	1	0	24	3	13	9	2	4	0	0	0	7	
Shansi	26	26	0	0	5	1	8	7	3	1	0	0	0	6	
Ninghsia	10	10	0	0	3	1	0	4	1	1	0	0	0	5	
Hopeh	135	138	0	0	42	2	44	13	20	9	0	3	2	8	
Inner Mongolia	64	65	1	0	11	3	6	17	8	7	0	0	1	8	
Yunnan	167	168	0	0	67	3	72	16	6	2	0	2	0	7	
Kweichow	46	47	0	0	21	2	18	4	1	0	0	0	0	5	
Szechwan	95	97	1	0	24	3	32	25	7	3	0	0	0	7	
Kansu	45	45	0	0	14	0	17	9	2	3	0	0	0	5	
Tsinghai	25	25	0	0	4	1	8	7	3	2	0	0	0	6	
Tibet	4	4	0	0	0	0	0	4	0	0	0	0	0	1	
Sinkiang	7	7	0	0	0	0	0	1	1	5	0	0	0	3	
(6) 总出现数(个)	2008	2032	7	2	603	80	610	371	190	111	1	22	9		
(7) 各小种出现百分率(%)	0.35	0.10	30.06	3.00	30.41	18.49	9.47	5.63	0.05	1.10	0.45	11			
(8) 优势小种出现百分率(%)					82.95		15.00								

1. Provincial origin of specimens; 2. Number of specimens;
3. Number of identifications; 4. Rate of appearance of physiological races and physiological strains; 5. Number of races
6. Total rate of appearance (Number);
7. Percentage of appearance of each race (%);
8. Percentage of appearance of dominant race (%).

In conclusion, the condition of growth and degeneration of the physiological races of wheat stem rust in 1964 showed the following three characteristics: (1) The racial dominance in 1963 was in the following order: 21 > 21C2 > 21C3 > 21C1 > 34 > 34C1; in 1964, the order of dominance was: 21C2 > 21 > 21C3 > 34 > 34C1 > 21C1 (Table 2). Thus in 1964, 21C2 was rising while 21C1 was obviously declining. (2) The above was the general order of ascendance and decline of the physiological races, but the situation was by no means completely uniform in the different provinces. For example, in the provinces of Kwangtung, Kiangsu, Anhwei, Kweichow, Shantung, Honan, Shensi and Hopeh, No. 21 remained the dominant race; in the provinces of Fukien, Kwangsi, Yunnan, Szechwan, Hupeh, Kirin, Shansi, Kansu and Tsinghai, No. 21C2 was obviously in the dominant position. (3) The last obvious characteristic of racial variation was the fact that the proportion of the racial group No. 34 was obviously on the rise. In the nine provinces of Chekiang, Kiangsu, Anhwei, Shantung, Liaoning, Kirin, Heilungkiang, Hopeh, Shensi and Inner Mongolia, the percentage of the physiological race No. 34 in 1964 was obviously greater than that of 1963. This ascending tendency was especially appreciable in the provinces of Shantung, Liaoning and Heilungkiang, where this race amounted to more than one-third. As far as the entire country is concerned, the year 1964 marked the highest year for the physiological race No. 34 since 1956.

Table 3. A Comparison of the Rate of Appearance of the Physiological Race No. 34 of Wheat Stem Rust in the Nine Provinces in 1963 and in 1964.

(1) 省 名	1963		1964	
	(2) 标本总个数 (个)	(3) 出现百分率 (%)	(4) 标本总个数 (个)	(5) 出现百分率 (%)
Chekiang	49	2.4	78	17.9
Kiangsu	212	4.3	231	12.6
Anhwei	67	4.5	117	12.8
Shantung	71	5.6	113	33.5
Liaoning	98	23.6	68	35.2
Kirin	120	5.0	199	15.2
Heilungkiang	103	13.0	174	35.7
Hopeh	44	4.5	135	21.5
Shensi	33	3.0	56	10.8
Inner Mongolia	3	—	54	27.7

1. Name of province; 2. Number of specimens (Number);
3. Rate of appearance (%); 4. Total number of specimens (Number);
5. Rate of appearance (%).

According to the analysis of the trend of growth and decline from 1962 to 1964, the dominance of the physiological racial group of wheat stem rust No. 21 declined year after year while that of the physiological racial group No. 34 rose year after year (see Table 4); therefore, with regard to the work of breeding stem rust resistant wheat varieties, both physiological racial groups should be given attention and the rust resistant varieties kept in reserve must be those varieties that are resistant to both physiological racial groups so that the danger of a sudden loss of rust resistance may be prevented.

Table 4. A Comparison of the Percentage of Growth and Decline of the Various Races of Stem Rust, 1962-1964.

年 (1)	17	19	21号小种 (2)	34号小种 (3)	40	104
1962	0.40	—	97.80	1.80	0.0	—
1963	0.10	0.20	91.10	7.10	1.60	—
1964	0.35	0.10	82.05	15.00	1.10	0.45

1. Year; 2. Physiological Racial Group No. 21;
3. Physiological Racial Group No. 34.